



HTRA1 gene

HtrA serine peptidase 1

Normal Function

The *HTRA1* gene provides instructions for making a protein that is found in many of the body's organs and tissues. This protein is a type of enzyme called a serine protease, which has an active center that cuts (cleaves) other proteins into smaller pieces. The HTRA1 enzyme helps break down many other kinds of proteins in the space surrounding cells (the extracellular matrix).

The HTRA1 enzyme also attaches (binds) to proteins in the transforming growth factor-beta (TGF- β) family and slows down (inhibits) their ability to send chemical signals.

TGF- β proteins normally help control many critical cell functions, including the growth and division (proliferation) of cells, the process by which cells mature to carry out specific functions (differentiation), cell movement (motility), and the self-destruction of cells (apoptosis). TGF- β signaling also plays an important role in the formation of new blood vessels (angiogenesis).

Researchers have proposed several additional functions for the HTRA1 enzyme. It may play a role in the stabilization of microtubules, which are rigid, hollow fibers that make up the cell's structural framework (cytoskeleton). Additionally, the HTRA1 enzyme may be involved in depositing minerals, such as calcium and phosphorus, in developing bone (mineralization). Studies have also suggested that the HTRA1 enzyme acts as a tumor suppressor, a protein that helps prevent the development of cancerous tumors by keeping cells from growing and dividing in an uncontrolled way.

Health Conditions Related to Genetic Changes

age-related macular degeneration

The *HTRA1* gene is located on the long (q) arm of chromosome 10 in a region known as 10q26. This region has been strongly associated with the risk of developing age-related macular degeneration, a common cause of vision loss in older adults. Researchers have identified several variations (polymorphisms) in the *HTRA1* gene that may explain the association between the 10q26 region and age-related macular degeneration. One of the variants, known as rs11200638, is found in an area of the gene called the promoter region, which starts the production of the HTRA1 enzyme.

It is unclear how a polymorphism in the *HTRA1* gene might be related to age-related macular degeneration. In the 10q26 region, the *HTRA1* gene is located next to a gene called *ARMS2*; changes in this gene have also been studied as a risk factor for

the disease. Because the two genes are so close together, it is difficult to tell whether changes in one gene or the other, or possibly changes in both genes, account for the increased disease risk. Age-related macular degeneration is a complex condition that likely results from a combination of multiple genetic and environmental factors.

cerebral autosomal recessive arteriopathy with subcortical infarcts and leukoencephalopathy

At least four mutations in the *HTRA1* gene have been found to cause cerebral autosomal recessive arteriopathy with subcortical infarcts and leukoencephalopathy, commonly known as CARASIL. This condition is characterized by a highly increased risk of stroke, deterioration of cognitive function (dementia), premature hair loss (alopecia), and attacks of low back pain. These signs and symptoms usually become apparent in early to mid-adulthood.

The *HTRA1* gene mutations responsible for CARASIL reduce or eliminate the function of the HTRA1 enzyme. As a result, the enzyme is not available to inhibit signaling by TGF- β proteins. Researchers suspect that abnormally increased TGF- β signaling alters the structure of small blood vessels, particularly in the brain. These blood vessel abnormalities increase the risk of stroke and lead to the death of nerve cells (neurons) in many areas of the brain. Dysregulation of TGF- β signaling may also underlie the hair loss and back pain seen in people with CARASIL, although the relationship between abnormal TGF- β signaling and these features is less clear.

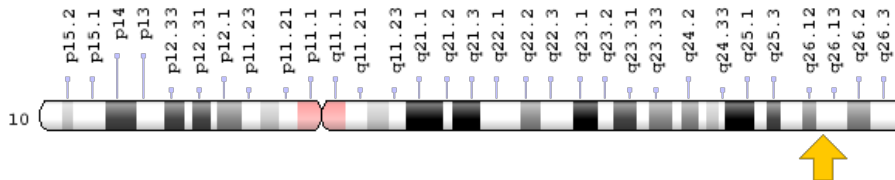
cancers

The *HTRA1* gene is less active (downregulated) in some cancerous tumors than in normal cells. Studies have found this gene downregulation in several forms of cancer, including ovarian cancer, cancer that occurs in the lining of the uterus (endometrial cancer), a form of skin cancer called melanoma, and a form of liver cancer called hepatocellular carcinoma. Having reduced amounts of the HTRA1 enzyme may be related to tumor progression, the risk that cancer will spread (metastasize) to other parts of the body, and resistance to treatment with chemotherapy. However, the mechanism by which downregulation of the *HTRA1* gene influences cancer development and growth is unknown.

Chromosomal Location

Cytogenetic Location: 10q26.13, which is the long (q) arm of chromosome 10 at position 26.13

Molecular Location: base pairs 122,461,525 to 122,514,908 on chromosome 10 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- ARMD7
- HtrA
- HTRA1_HUMAN
- IGFBP5-protease
- L56
- ORF480
- protease, serine, 11 (IGF binding)
- PRSS11
- serine protease HTRA1

Additional Information & Resources

Educational Resources

- Basic Neurochemistry (sixth edition, 1999): Transforming growth factors β are the prototypical members of a superfamily of related factors which have diverse roles both in development and in the mature animal
<https://www.ncbi.nlm.nih.gov/books/NBK28185/#A1373>
- Eureka Bioscience Collection: TGF β Signaling
<https://www.ncbi.nlm.nih.gov/books/NBK6525/#A31193>

- Neuroscience (second edition, 2001): Macular Degeneration
<https://www.ncbi.nlm.nih.gov/books/NBK10850/box/A754/>
- Webvision: The Organization of the Retina and Visual System (2008): Molecular genetics of AMD
https://www.ncbi.nlm.nih.gov/books/NBK27323/#maculardegen.Molecular_genetics_of_AMD

GeneReviews

- CARASIL
<https://www.ncbi.nlm.nih.gov/books/NBK32533>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28HTRA1%5BTIAB%5D%29+OR+%28HtrA+serine+peptidase+1%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5BIa%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D>

OMIM

- HTRA SERINE PEPTIDASE 1
<http://omim.org/entry/602194>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
<http://atlasgeneticsoncology.org/Genes/HTRA1ID41877ch10q26.html>
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=HTRA1%5Bgene%5D>
- HGNC Gene Family: PDZ domain containing
<http://www.genenames.org/cgi-bin/genefamilies/set/1220>
- HGNC Gene Family: Proteases, serine
<http://www.genenames.org/cgi-bin/genefamilies/set/738>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=9476
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/5654>
- UniProt
<http://www.uniprot.org/uniprot/Q92743>

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